EJPMR, 2026, 13(9), 125-131 **Research Article** **Impact Factor: 8.158**

EUROPEAN JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH

www.ejpmr.com

ISSN (O): 2394-3211

ISSN (P): 3051-2573

Coden USA: EJPMAG

INTENSITY OF INTESTINAL HELMINTHIASIS IN RELATION TO ABO BLOOD GROUP AMONG PRIMARY SCHOOL PUPILS OF MARABAN RIDO, KADUNA STATE, NIGERIA

Unuabonah F. H.[1], Danladi J.[1], Okodua M. A.[1], Iserhienihien O.[2], Eyaufe A. O.[3*]

[1]Department of Medical Microbiology, Faculty of Medical Laboratory Sciences, Ambrose Alli University, Ekpoma, Edo State, Nigeria.

[2]Department of Community Medicine, Faculty of Clinical Sciences, Ambrose Alli University, Ekpoma, Edo State, Nigeria.

[3]Department of Microbiology, Faculty of Life Sciences, Ambrose Alli University, Ekpoma, Edo State, Nigeria.

***Corresponding Author: Eyaufe A. O.**

Department of Microbiology, Faculty of Life Sciences, Ambrose Alli University, Ekpoma, Edo State, Nigeria.

DOI: https://doi.org/10.5281/zenodo.22158442

How to cite this Article: Unuabonah F. H.[1], Danladi J.[1], Okodua M. A.[1], Iserhienihien O.[2], Eyaufe, A. O.[3*] (2026). Intensity Of Intestinal Helminthiasis In Relation To Abo Blood Group Among Primary School Pupils Of Maraban Rido, Kaduna State, Nigeria. European Journal of Pharmaceutical and Medical Research, 13(9), 125–131.

Article Received on 22/07/2026 **Article Revised on 12/08/2026** **Article Published on 01/09/2026**

ABSTRACT

Intestinal helminths cause annual preventable deaths. The helminthic burden and related morbidity varies from place to place. This study determined the relationship between intensity of intestinal helminthiasis and A B O Blood group among Primary School Pupils of Maraban Rido, Chikun Local Government Area, Kaduna State. A total of three hundred and fifty (350) stool and blood samples were collected from the study population. Formol ethyl acetate concentration method and Stoll's dilution technique were used for stool examination and egg count respectively. Direct cell grouping methods were used to determine the ABO blood group. Pupils with blood group O were 50.0 %, group A were 21.1%, group B were 22.6%, and group AB were 6.3%.The Rhesus distribution showed that, 95.1 % were Rhesus positive while 4.9% were Rhesus negative. The overall prevalence of intestinal helminths was 22.6%. Infection by Hookworm was 14.0 %, *Ascaris lumbricoides* and *Taenia* spp. Were 3.1% each and *Schistosoma mansoni* was 2.3 %. Infectivity by blood group revealed that, blood group O had total infectivity rate of 17.7% with mean egg count of 306.4561 EPG; blood group A had 27.0% infectivity with mean egg count of 330.0000 EPG; blood group B had 30.4% infectivity with mean egg count of 583.3333 EPG; and blood group AB had infectivity of 18.2% with mean egg count of 225.000EPG. There was statistically significant difference between the intestinal helminthiasis and the various blood group ($P<0.05$). Turkey's post hoc test revealed that, pupils of blood group B has more likelihood of having high intensity of intestinal helminthiasis than other blood groups ($P<0.05$). We recommend intensive health education, provision of pipe borne water, improvement in environmental sanitation and continuous deworming campaign in this community.

KEYWORDS: Intestinal helminths, Blood group, Pupils, Intensity, Relationship.

INTRODUCTION

Intestinal helminths have played a vital role in undermining the health status of populace thereby hindering the development of Tropical countries economically (Kuboye, Nock, Aken'oven & Ndams, 2017). Several factors were suggested to be implicated in the severity of intestinal helminthiasis. The severity and related morbidity varies from place to place due to host and environmental factors. Blood group is one of the host factors implicated in the variation of helminthic infection. The ABO blood groups consists of groups A, B, AB and O and each of these is either Rh-positive or Rh-negative (Ayenew, Zinaye, Amare, Ababe, Habte, Belete & Andargachew, 2016). The nature of the relationship between helminths infections and the ABO blood group is uncertain, although researches have documented a high prevalence of *Schistosoma mansoni* infection and high morbidity in individuals with blood type A and blood type B (Degarege, Aminat, Medhin, Legesse & Erko, 2014). This was proposed to be due to N-acetyl-D-galactose polysaccharides in *Schistosoma mansoni* which have a structural similarities to

substances in the A and B blood groups (Zaky, El-Gindy & El-Badry, 2019). The *Schistosoma mansoni* polysaccharides may serve as receptors to adsorb A and B antigens, leading to concealment of target antigens on the helminth's surface. This mechanism was found to be used by *S. mansoni* to escape the host immune system and cause greater morbidity in patients with blood types A and B. Susceptibility to helminthic infection has been associated with blood type, and individual with a certain blood type cannot mount an adaptive immune response to helminths (Gombe, Manga & Yari, 2021). Studies have documented association of blood group with severity of diseases such as malaria, cholera, ulcer, etc (Silamlak, 2021). Studies have also demonstrated that, intestinal helminthiasis reduced growth rate, cognitive ability and anaemia in children due to heavy infection (Obeta, Ejinaka, Jwanse, Lote-Nwanu & Ibrahim, 2019). About two billion people are infected with intestinal helminths yearly (WHO, 2020). Children are particularly susceptible to the adverse effects of helminthic infections due to their incomplete physical development and their greater immunological vulnerability (Montresor, 2002). It has been estimated that approximately 300 million people have severe morbidity due to intestinal helminths of which 10,000-135,000 deaths occur annually (Hussein, Alemu & Ayehu, 2022). The public health implication of intestinal helminthiasis, variations in its intensity, mortality associated with its intensity, as well as paucity of data on relationship of intensity of intestinal helminths and blood group in the study area prompted this research work. The study is therefore aimed at investigating the relationship between intensity of intestinal helminths and ABO blood group.

MATERIALS AND METHODS

Study Area

The study area (Maraban rido) is located in Chikun Local Government Area of Kaduna State. Chikun Local Government is located between latitude 10^0 19^0-10^0 29^0 North and longitude $7^0 14^0$-$7^0 25^0$ East (Olayiwola, 1997). The Local Government Area has boundary with Kaduna South, Igabi, Kachia and Kajuru Local Government Areas. The total population of the Local Government Area is 372,272. It has an area of 4,646 km^2 with density of 108.2 /km^2 (Census, 2006). Rainy season is from May to October and dry season from November to April. The inhabitants are predominately farmers and petty traders with Gbagyi as the major tribe.

Ethical Consideration: Ethical permission was obtained from the ethics committee of the Local Government Area Education Authority.

Study Population: The study population are pupils from Primary School in Maraban Rido who are within the ages of 3-15 and from primary 1-6.

Sample Collection: The pupils were taught on how to provide the early morning stool samples into a wide-mouthed screw cap container labelled with each pupil's name, gender, age, research number, and class**.** The stool samples collected were preserved in 10% formol-saline for laboratory analysis as described by Belyhum, Girmay & Alemayehu (2010). Blood sample (1-2ml) was collected into EDTA bottles as described by Nanda (2015).

Laboratory Analysis

The 350 stool samples were analyzed in the Public Health Laboratory, Department of Community Medicine, Kaduna State University. Stool microscopy was done using formalin- ethyl acetate concentration technique as described by CDC, (2016). The egg count was done using modified Stoll dilution technique as described by Ochei & Aundhati, (2008). Direct ABO blood cell grouping was done based on the method described by Shirish, (2013).

Statistical Analysis: Results obtained were analyzed using statistical package for social sciences (SPSS) version 23 software. Percentage was used to determine the prevalence rate of the infection among the study subjects. Chi-square was used to determine the relationship of the intensity of intestinal helminthiasis with ABO blood group and relationship of the intensity of intestinal helminthiasis with risk factors, one way ANOVA was used to determine the difference in intensity in relation to blood group, Turkey's post hoc was used to determine blood group whose intensity differs from others and results considered significant when p-values are less than 0.05.

RESULTS

The study on the intensity of intestinal helminthiasis in relation to blood group showed that, 50.0% of the pupils belongs to blood group O, 21.1% belongs to blood group A, 22.6% belongs to blood group B and 6.3% were blood group AB, the rhesus distribution showed that, 95.1% were rhesus positive while 4.9% were rhesus negative (Figure 1). The overall prevalence of intestinal helminthiasis was 22.6%. Hookworm infection had highest prevalence of 14.0% followed by *Ascaris lumbricoides* and Taenia spp. with 3.1% each and *Schistosoma mansoni* had the least prevalence of 2.3% (Table 1). The occurrence of intestinal helminths in relation to blood group revealed that, blood group B pupils had the highest infectivity (30.4%), followed by Blood group A (27.0%), the group with least prevalence of infection was blood group O (17.7%) (Table 2).There was statistically significant relationship between the intensity of intestinal helminths infection and blood group ($P<0.05$). Pupils with blood group B has the highest mean egg count of 583.333 EPG while Blood group AB had the least mean egg count of 225.000 EPG (Table 3).

One way ANOVA indicates that, there is significant difference in the intensity of intestinal helminths in relation to blood groups of the pupils at 5% level of significance (F=18.790, DF=(3,75), P-Value=0.000), P-

value <0.05 (Table 4 and 5). Turkey's post hoc test indicates that, the intensity of Blood group B is significantly difference from other blood groups (O, A and AB) P<0.05 (Table 6). This places group B at the risk of having high intensity of intestinal helminths than any other blood group. One-way ANOVA test conducted to determine if there is significant difference in the intensity of intestinal helminthiasis amongst the pupils in this study according to ABO blood group using the F distribution. The Table indicates a statistical significance difference at 5% level of significance ($F_{(3, 75)}$ = 18.79, P < 0.05). This implies that there is statistical significant difference in the intensity of intestinal helminthiasis amongst the pupils in this study according to ABO blood group. Turkey's post-hoc test output to determine the blood group whose intensity is significantly statistically different from the other blood groups indicates that the intensity among blood group B pupils is significantly different from others (P<0.05). This implies that blood group B is the most associated with high intensity of intestinal helminthiasis.

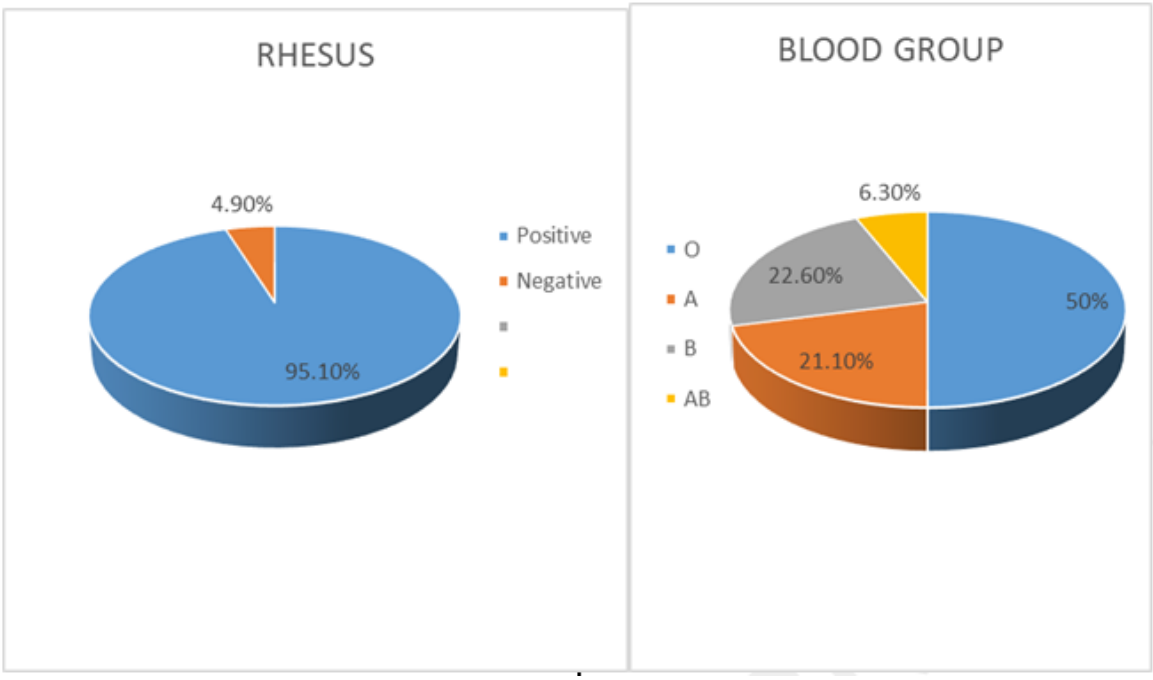

Fig 1: Blood group/ Rhesus distribution among the pupils.

Table 1: Prevalence of intestinal Helminths among the Pupils.

Intestinal helminths	No. examined	No. infected (%)	Mean Egg count (EPG)
Hookworm	350	49 (14.0)	418.3673
A. lumbriciodes	350	11 (3.1)	336.3636
Taenia spp.	350	11 (3.1)	363.6364
S. mansoni	350	8 (2.3)	350.000
Total		**79 (22.6)**	**392.4051**

Table 2: Intensity of intestinal helminths in relations with Blood Group of the pupils.

Blood Group	N	AL	HK	Taenia	SM	Total	Mean egg count (EPG)
0	175	5(2.9)	24(13.7)	2(1.1)	0(0.0)	31 (17.7)	306.4561
A	74	3(4.1)	9(12.2)	3(4.1)	5(6.8)	20(27.0)	330.0000
B	79	3(3.8)	15(19.0)	4(5.1)	2(2.5)	24(30.4)	583.3333
AB	22	0(0.0)	1(4.5)	2(9.1)	1(4.5)	4(18.2)	225.000
Total	**350**	**11(3.1)**	**49(14.0)**	**11(3.1)**	**8(2.3)**	**79(22.6)**	**392.4051**

χ^2=17.307, P-value=0.044*, P-value <0.05 is statistically significant

N= number examined, AL=*Ascaris lumbricoides*, HK= Hookworm, SM= *Schistosoma mansoni*

Table 3: Mean egg count with Blood group.

Blood Group	Parasites	Mean egg count (EPG)	Std. Deviation	N
O	AL	260.0000	89.44272	5
	HK	316.6667	227.78072	24
	Taenia	300.0000	.00000	2
	Total	**306.4516**	**203.20020**	**31**
A	AL	300.0000	.00000	3
	HK	366.6667	70.71068	9
	Taenia spp	300.0000	.00000	3
	SM	300.0000	.00000	5
	Total	**330.0000**	**57.12406**	**20**
B	AL	500.0000	.00000	3
	HK	620.0000	156.75276	15
	Taenia spp	525.0000	50.00000	4
	SM	550.0000	70.71068	2
	Total	**583.3333**	**134.05601**	**24**
AB	HK	300.0000	.	1
	Taenia spp	200.0000	.00000	2
	SM	200.0000	.	1
	Total	**225.0000**	**50.00000**	**4**
Total	AL	336.3636	120.60454	11
	HK	418.3673	227.00355	49
	Taenia spp	363.6364	136.18170	11
	SM	350.0000	130.93073	8
	Total	**392.4051**	**196.62026**	**79**

AL= *Ascaris lumbricoides* HW= Hook worm SM= *Schistosoma mansoni*

Table 4: One Way Analysis of Variance Test for intestinal Helminthiasis Intensity with Blood Group.

Blood group	No. infected	Mean egg count (EPG)	Std. Deviation	Std. Error	Minimum egg count	Maximum egg count
O	31(17.7)	306.4516	203.20020	36.49583	100.00	1000.00
A	20(27.0)	330.0000	57.12406	12.77333	300.00	500.00
B	24(30.4)	583.3333	134.05601	27.36407	500.00	1100.00
AB	4 (18.2)	225.0000	50.00000	25.00000	200.00	300.00
Total	**79(22.6)**	**392.4051**	**196.62026**	**22.12151**	**100.00**	**1100.00**

Table 5: One way ANOVA Table Showing F distribution table.

	Sum of Squares	Df	Mean Square	F	p-value
Between groups	1293900.027	3	431300.009	18.790	.000*
Within groups	1721543.011	75	22953.907		
Total	3015443.038	78			

P<0.05 (*) is statistically significant

Table 6: Turkey's Multiple Comparison Test.

(I) Blood Group	(J) Blood Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
O	A	-23.5484	45.30391	.954	-143.0039	95.9071
	B	-276.8817*	42.94784	.000*	-390.1249	-163.6386
	AB	81.4516	83.92080	.767	-139.8274	302.7306
A	O	23.5484	45.30391	.954	-95.9071	143.0039
	B	-253.3333*	47.82469	.000*	-379.4356	-127.2311
	AB	105.0000	86.51812	.621	-123.1275	333.1275
B	O	276.8817*	42.94784	.000*	163.6386	390.1249
	A	253.3333*	47.82469	.000*	127.2311	379.4356
	AB	358.3333*	85.30801	.000*	133.3966	583.2701
AB	O	-81.4516	83.92080	.767	-302.7306	139.8274
	A	-105.0000	86.51812	.621	-333.1275	123.1275

	B	-358.3333*	85.30801	.000*	-583.2701	-133.3966
*=statistically significant						

DISCUSSION

The results from this research reveals that, 50% of the pupils examined belongs to Blood group O while the least belongs to blood group AB. The blood group distribution is similar with the work of Bakare, Azeez & Agbolade, (2006) in Oyo state that recorded, blood group O 50.0%, blood group A 22.9%, blood group B 21.3 % and blood group AB 5.9%. The research was slightly different from the work of Etim, Akpotuzor, Ohwonigbo & Francis, (2017) in Adamawa State who reported blood group O; 50.0%, blood group A; 17.7%, blood group B; 21.3% and blood group AB; 4.7%. The Rhesus distribution revealed, rhesus positive was 95.1%, rhesus negative was 4.9%, this is slightly different from the work of Erhabor, Babangida, Onuigwe, Abdulrahman, Isaac, Adias, Ezimah, Ibrahim, Buhari, Okwesihi, Ahmad & Yeldu, (2014) in Sokoto that reported rhesus positive 89.2% and rhesus negative 10.8%, which due to differences in genetic make-up.

Overall prevalence of 22.6% of intestinal helminthic infections was reported in this research, this is lower compared with the work of Nock, Duniya & Galadima, (2013) who reported 52.0% in their work in Kaduna State, this may be due intervention by some Non-Governmental Organization and Federal Ministry of Health. The ova of hookworm, *Ascaris lumbricoides*, Taenia spp. and *Schistosoma mansoni* were recovered. The study also showed hookworm with the highest infectivity, followed by *Ascaris lumbricoides* and *Taenia* spp and *Schistosoma mansoni* had the least. The study agrees with the work of Anosike, Zaccheaus, Adeiyongo, Dada, Keke, Uzeazuoka, Amajuoyi, Obiukwu, Nwosu & Ogbuju, (2016) who in their work in Central Nigeria rural Community recorded highest prevalence of hookworm (12.7%), this may be due to the habit of walking barefooted observed among the study population.

The infectivity based on blood group revealed that, Blood group B had the highest infectivity followed by Blood group A while the least is Blood group O. This results agree with the work of Degarege, Animut, Medhin, Legesse & Erko, (2012), who reported high infectivity rate among blood group B (63%). Blood group A has the highest infectivity of *Ascaris lumbricoides*, Blood group B has highest infectivity of Hookworm, Blood group AB has the highest infectivity of *Taenia* and Blood group A has the highest infectivity of *Schistosoma mansoni*. The chi-square test showed that, there is statistical significant relationship between blood group and intestinal helminths P<0.05. This finding agreed with that of Ayenew *et al.*, (2016), who recorded statistical significant relationship between intestinal helminths and blood group. The finding also agreed with finding of Degarege, Yiman, Madhivanan & Erko, (2017), who reported statistical significant relationship between blood group and intestinal helminths infection (AOR) 2.08, 95% confidence interval (CI), 1.22-3.56). However, the finding is at variance with that of Gabr & Mandour, (1991); and Cooper, Guevara & Guderian, (1993) who reported non-association of intestinal helminths and blood group. One way Analysis of variance (ANOVA) showed, the variation among the blood groups in relation to intensity of intestinal helminthic infections was statistically significant P<0.05. When subjected to Turkey's multiple comparison test (post hoc), the intensities of blood group O, A and AB are significantly different from that of blood group B (P<0.05). This implies that, blood group B is the most associated with intensity of intestinal helminths. Studies have shown that, polysaccharides that resemble substances in blood group B have been identified in *Ascaris lumbricoides*, hookworm and *Schistosoma mansoni* which can adsorb blood group substances to mask target antigen on the parasite surface (Haseeb *et al.*, 2008). *Ascaris lumbricoides* extracts from blood group B individual prohibit agglutination of anti-B antibodies, this suggests that *Ascaris lumbricoides* mimics antigens of infected blood B individual, thus the immune system of such individual may not be effective, leading to high morbidity in such an individual (Deleon, Foreto, Zdero, & Valverdeh, 2000; Deleon & Valverdeh, 2003; Haseed, Thors, Linder & Eveland, 2008*)*. The report agreed with the works of Trangle, Goluska, O'Leary & Douglas (1979); Haseeb *et al.*, (2008) who in their work reported high morbidity of intestinal helminths among blood B persons. However, the findings contradicts that of Ayenew *et al.,(*2016), who in their research among primary school children in Sanja, Northwest Ethiopia, reported high intensity of intestinal helminths among individuals with blood group AB (4.2 odds ratio, 95% CI, 1,3.13.7) , the difference may be due racial distribution difference. The study also contradicts the work of Degarege *et al., (*2017); Wokem, Abah, & Iwuaba, *(*2016) whom reported susceptibility of children with blood A and O to heavy intestinal helminthic infections. The difference may be due to genetic make-up.

CONCLUSION

Although all blood groups are susceptible to intestinal helminthic infection, Blood group B have more intensity than others and its intensity is significantly different from other groups, making it the Blood group associated with intensity of intestinal helminths.

ACKNOWLEDGEMENT

We wish to acknowledge the staff of Public Health Laboratory, Department of Community Health, Kaduna State University for assistance rendered during this research work. Our profound gratitude also goes to Pupils of Local Government Education Authority Primary School, Ungwan Kadara, Maraban Rido, Chikun

Local Government Area, Kaduna State. whose blood and stool were used for this work.

REFERENCES

1. Anosike, J.C., Zaccheaus, V.O., Adeiyongo, C. M., Abanobi, O.C., Dada, E. O., Keke, I.R., Uwaezuoka, J. C., Amajuoyi, O. U., Obiukwu, C. E., Nwosu, D. C. & Ogbuju, F. J. (2016). Studies on the Intestinal worm (Helminthiasis) Infestation in Central Nigeria Rural Community. *Journal of Applied Environmental Management,* 10(2): 61-66.
2. Ayenew, A., Zinaye, T., Amare, T., Ababe, A., Habte, T., Belete, B.& Andargachew, G. (2016). The Association between ABO Blood groups and Intestinal Schistosomiasis among Masero Primary School Children in Sanja, North-West Ethiopia. *Journal of Tropical Diseases,* 4(2): 2-5.
3. Bakare, A. A., Azeez, M. A. & Agbolade, J.O. (2006). Gene frequencies of ABO and Rhesus Blood groups and Haemoglobin variants in Ogbomoso South-west, Nigeria. *African Journal of Biotechnology,* 5(3): 224-229.
4. Belyhun, Y., Girmay, M. & Alemayehu, A. (2010). Prevalence and risk factors for Soil Transmitted Helminth Infection in mothers and their children in Butajira, Ethiopia: a population based study. *BMC Public Health,* 10**:** 1-2.
5. Centre for Disease Control (CDC, 2016). DPDX: Laboratory identification of parasites of Public Health Concern, Atlanta: Centre for Disease Control and Prevention, USA.
6. Chigozie, J. U., Kelvin, O. E., Patrick, G.O., Nelson. C. A. & Emmanuel, A. (2007). Soil Transmitted Helminth Infection in school children in South-Eastern Nigeria: the public health implication. *The Internet Journal of the third World Medicine,* 4(1): 23.
7. Cooper, P. J., Guevara, A. & Guderian, R. H. (1993). Intestinal Helminthiasis in Ecuador: the relationship between Prevalence, genetic, and socioeconomic factors. *Revista da Sociedade Brasileira de Medicina Tropical,* 26**:** 175-180.
8. Degarege, A., Animut, A., Medhin, G., Legesse, M. & Erko, B. (2012). The association between multiple Intestinal Helminth Infections and Blood group, anaemia and nutritional status in human populations from Dore Bafeno, Southern Ethiopia. *Journal of Helminthology, doi:*10.1017/S0022149X12000855.
9. Degarege, A., Animut, A., Medhin, G., Legesse, M. & Erko, B. (2014). The association between multiple Intestinal Helminth Infections and Blood group, anaemia and nutritional status in Human Populations from Dore Bafeno, Southern Ethiopia. *Journal of Helminthology, doi:10.1017/S0022149*X12000855.
10. Degarege, A., Yiman, Y., Madhivanan, P. & Erko, B. (2017). The relationship between helminth infections and low haemoglobin levels in Ehiopia Children with blood type A. *Journal of Helminthology,* 91(3): 278-283.
11. Deleon, P. P., Foresto, P., Zdero, M. & Valverdeh, J. (2000). Preliminary studies on antigenic mimicry of *Ascaris lumbricoides. Revista do Instituto de Medicina Tropical de sao Paulo,* 42: 295-296.
12. Deleon, P. P. & Valverdeh, J. (2003). System antigenic determiners expression in *Ascaris lumbricoides. Revista do Instituto Medicina Tropical de sao Paulo,* 45: 53-54.
13. Etim, E. A., Akpotuzor, J. O., Ohwonigbo, A. C. & Francis, A. A. (2017). Distribution of ABO and Rhesus Blood group in Adamawa State, Nigeria. *Haematology Transfusion International Journal,* 4(6): 00102. Doi:10.15406/httj.2017.04.00102.
14. Erhabor, O., Babangida, S., Onuigwe, F. U., Abdulrahman, Y., Isaac, Z., Adias, T.C., Ezima, A.C.U., Ibrahim, K., Buhari, H., Okweshi, A., Ahmed, M. & Yeldu, M. H. (2014). ABO and Rhesus D blood groups distribution among students in Usman Danfodiyo University, Sokoto, North-Western Nigeria. *Jacobs Journal of Emergency Medicine,* 1(2): 008.
15. Ezeagwuna, D., Okwelogu, I., Ekejindu, I. & Ogbuagu, C. (2010). The prevalence and socioeconomic factors of Intestinal Helminth Infections among Primary School pupils in Ozubulu, Anambra State, Nigeria. *The International Journal of Epidemiology,* 9(1): 8.
16. Gabr, N. S. & Mandour, A. M. (1991). Relation of Parasitic Infection to Blood group in Elminia Governorate, Egypt. *Journal of Egyptian Society of Parasitology,* 21**:** 679-683.
17. Gombe, N.T., Manga, S.B. & Yari, A. (2021). The Relationship between Blood groups and susceptibility to intestinal parasitic infections in Gombe, Nigeria. *Journal of Immunology and immunotherapy,* 2(1): 28-32.
18. Haseed, M. A., Thors, C., Linder, E. & Eveland, L. K. (2008). *Schistosoma mansoni:* Chemoreception through N-Acetyl-D-galactosamine –containing receptors in females offers insight into increase severity of Schistosomiasis in individuals with ABO blood group A. *Experimental Parasitology,* 119**:** 67-73.
19. Hussein, A., Alemu, M. & Ayehu, A. (2022). Soil contamination and infection of School Children by Soil – Transmitted Helminths and Associated Factors at Kola Diba Primary School, Northwest Ethiopia: An institution –Based Cross-sectional Study. *Journal of Tropical Medicine,* August 3: doi:10.1155/2022/4561561.
20. Kuboye, S., Nock, I. H., Aken'oven, T. O. L. & Ndams, I. S. (2017). Occurrence of Intestinal Helminths among Nursery School Pupils in Sabon Tasha, Chikun Local Government Area, Kaduna State, Nigeria. *Journal of Tropical Bioscience,* 12: 88-89.
21. Monstresor, A. (2002). Helminth Control in School-Age Children. A Guide for managers of Control Programs. World Health Organization.

22. Nanda, M. (2015). Clinical Pathology, Haematology and Blood Banking (for DMLT Students). Second edition. Jaypee Brothers Medical Publishers (p) LTD, New Delhi. 12-13.
23. National Population Commission (2006). Federal Republic of Nigeria 2006 Population Census. www.population.gov.ng/files/nationafinal.pdf.
24. Ndamba, J., Gomo, J. E., Nyazema, N., Makaza, N. & Koandera, K. C. (1997). Schistosomiasis Infection in relation to the ABO Blood group among School Children in Zimbabwe. *Acta Tropica*, 65**:** 181-190.
25. Nock, H., I., Duniya, D., & Galadima, M., (2013). Geohelminth Eggs in the soil and stool in pupilsof some primary school in samaru Zaria, Nigeria. *The Nigerian Journal of Parasitology*, 24: 115–122.
26. Obeta, M.U., Ejinaka, O.R., Jwanse, R.L., Lote-Nwanu, I.E. & Ibrahim. A. (2019).Prevalence and Distribution of Soil-Transmitted Helminths Among Children Attending Township Primary School, Jos, Plateau State, Nigeria. *London Journal of Medical and Health Research*, 19(1): 55-62.
27. Ochei, J. & Arundhati, A. K. (2008). Medical Laboratory Science (Theory and practice), 7th edition. Tata McGraw-Hill publishing company limited, New Delhi. 952.
28. Olayiwola, A. (1997). The role of Kaduna Refining and Petrochemical Company (KRPC) on the Development of Chikun Local Government Area, Kaduna.
29. Shirish, M. K. (2013). Essentials of Haematology, 2nd edition. Jaypee Brothers Medical Publishers (p) LTD, London. 463-465.
30. Silamlak, B.A. (2021). Human ABO Blood Groups and Their Associations with Different Diseases. *Biomedical Research International*, (2021): 6629060.doi: 10.1155/2021/6629060. PMID: 33564677; PMCID: PMC7850852.
31. Trangle, K. L., Goluska, M. J., O'Leary A. & Douglas, S. D. (1979). Distribution of Blood groups and secretor's status in Schistosomiasis. *Parasite Immunology*, 1:133-140.
32. Wokem, G.N., Abah, E. & Iwuaba, P. A. (2016). Hookworm Infection and ABO Blood Group among children in Aba metropolis, Abia state, Nigeria. *World Applied Sciences Journal*, 34(9):1216-1221.
33. World Health Organizatio, (2020). Soil Transmitted Helminth Infection. http:// www.who.int/newsroom/fact-sheets/detail/soil-transmitted-helminth-infections.
34. Zaky, W.I., El-Gindy, I.M. & El-Badry, A.A. (2019). Association between ABO Blood groups and susceptibility to Schistosomiasis. *Parasitology Research*, 18(6): 1915-1922.